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The State Of The Missile Technology Control Regime

Tyler J. Knox
University of Pennsylvania

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Keywords
ballistic missile, missile proliferation, missile technology control regime, export regime, global security, security policy, foreign policy

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Tyler Knox
The Wharton School | University of Pennsylvania
Email: tknox@wharton.upenn.edu
Phone: (845)-774-5160

Advised by Dr. Michael C. Horowitz, Ph.D.
Associate Professor of Political Science
Associate Director of the Perry World House
University of Pennsylvania
Email: horom@sas.upenn.edu
Phone: (215)-898-6155

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Abstract

The 1987 Missile Technology Control Regime is a multilateral ballistic missile export regime of members ("Partner States") who have pledged to strengthen international non-proliferation efforts through export controls. Has the MTCR succeeded in restricting ballistic missile proliferation? This paper seeks to answer this question, and explore if the Missile Technology Control Regime is in need of reform after three decades by drawing upon a compiled data set on all ballistic missiles possessed by the world's nations as of May 2017. By evaluating missile diffusion over time on a global and regional basis, this paper concludes that the MTCR has succeeded in slowing down the rate of proliferation and restricting the new missile powers to missiles of relatively basic sophistication. However, the Missile Technology Control Regime must be strengthened, considering the omission of the Middle East from the Regime, the ability of missile transfers to catalyze domestic development, and the subversion of the MTCR by its own Partner States.

Keywords

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Introduction

Ballistic missiles have been critical components of many nations' military arsenals since the conclusion of World War II. The first conventional ballistic missile, the V-2, was developed by Nazi Germany in the 1930's and 1940's, and deployed against the Allied powers throughout World War II[1]. With the ability to strike distant targets and deliver chemical, biological, and nuclear payloads, ballistic missiles have long been significant to discussions of global geopolitical security with the capacity to wreak significant danger to strategic civilian and military targets. Considering this, ballistic missiles differ in regard to their technical specifications: range, speed, payload, propulsion and guidance systems, accuracy (measured in CEP), method of launch, and nuclear capability. Ballistic missile variants are understood in terms of these variables. Ballistic missiles are first classified by their range: Short-range (less than 1,000 km), medium-range (1,000 - 3,000 km), intermediate-range (3,000 - 5,500 km), and intercontinental (more than 5,500 km)[2]. Most importantly, the particular technical specifications of a nation's ballistic missiles are linked to the strategic nature of that nation's arsenal. If an Asian-Pacific country possesses only short-range ballistic missiles, they lack the ability to order a missile strike across the Atlantic Ocean, for example.

Ballistic missile proliferation is a critical threat to international security. As such, the United States and other nations have devoted significant attention and resources to anti-proliferation efforts. Preventing the rise of new states with ballistic missile capabilities is a complicated

[1] "V-2 Missile." National Air and Space Museum. September 06, 2017. Accessed February 07, 2018. https://airandspace.si.edu/collection-objects/missile-surface-surface-v-2-4.
[2] Davenport, Kelsey. "Worldwide Ballistic Missile Inventories." Arms Control. December 2017. Accessed February 07, 2018. https://www.armscontrol.org/factsheets/missiles.

endeavor, premised on limiting the transfer of missiles, missile technology, and the financial and human capital ("soft technology") necessary to successfully develop a medium-range, intermediate-range, or intercontinental missile. At the forefront of the international effort to limit missile proliferation is the 1987 Missile Technology Control Regime (MTCR), a multilateral export regime of members ("Partner States") who have pledged to strengthen international non-proliferation efforts through export controls, regular meetings, and dialogue with non-Partners. The MTCR is an informal political consensus or a pact, per se, as it does not impose legal obligations upon its Partners. Instead, member states agree to work together to limit missile proliferation by following the MTCR Guidelines and MTCR Annex. The Guidelines prescribe the common export control policy followed by MTCR Partners, while the Annex denotes the list of controlled items (equipment, materials, software, and technology) necessary for missile development, production, or operation[3].

This paper seeks to examine the efficacy of the 1987 Missile Technology Control Regime. Has the MTCR succeeded in restricting ballistic missile proliferation? In light of an evolving geopolitical landscape and the ability to aspiring proliferators to subvert export controls or seek alternative technologies, is the Missile Technology Control Regime in need of reform?

Research Significance

The importance of ballistic missiles to global security has gained even greater attention in the context of contemporary regional conflict on the Korean Peninsula and in the Middle East. Efforts by the North Korean government to successfully develop a nuclear-capable, long-range

[3] "MTCR Guidelines and the Equipment, Software and Technology Annex." MTCR. September 30, 2016. Accessed February 07, 2018. http://mtcr.info/mtcr-guidelines/.

ballistic missile has stoked regional tensions in the Asia-Pacific region and provoked widespread condemnation from the West and around the world. Since late 2017, North Korea is believed to have tested numerous ballistic missile variants, with American intelligence officials believing that North Korea has successfully developed an intercontinental missile capable of striking the entirety of the continental United States[4]. The threat of North Korean missile development has contributed to a renewed focus on missile defense in the United States, with the deployment of the Terminal High Altitude Area Defense (THAAD) system to the Korean peninsula in early 2017 to protect South Korea proper. THAAD is an anti-ballistic missile defense system designed and built by Lockheed Martin and several defense contractors under the aegis of the U.S. military with the ability to target and neutralize short- and intermediate-range ballistic missiles[5]. As of writing, the Pentagon has also successfully destroyed a mock ICBM over the Pacific Ocean with a ground-based interceptor missile launched on May 30, 2017 from Vandenberg Air Force Base in California[6]. In the Middle East, ballistic missiles have figured prominently in both the Yemeni Civil War (2015-) and Syrian Civil War (2011-), with the latter conflict involving the deployment and almost-depletion of Syria's ballistic missile arsenal[7,8]. Lastly, a better understanding of the efficacy of the MTCR will determine if the 1987 export regime is indeed working as intended after three decades, and if not, how to best enact reforms to strengthen anti-proliferation efforts.

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[4] Cohen, Zachary, Ryan Browne, and Nicole Gaouette. "New missile test shows North Korea capable of hitting all of US mainland." CNN. November 30, 2017. Accessed February 07, 2018. https://www.cnn.com/2017/11/28/politics/north-korea-missile-launch/index.html.

[5] ISDP. "THAAD on the Korean Peninsula." Institute for Security and Development Policy. October 2017. Accessed February 07, 2018. http://isdp.eu/publication/korea-thaad/.

[6] Bendix, Aria. "U.S. Conducts Successful Missile Defense Test." The Atlantic. May 30, 2017. Accessed February 7, 2018. https://www.theatlantic.com/news/archive/2017/05/us-conducts-successful-missile-defense-test/528591/.

[7] Reuters Staff. "Israel says 90 pct of Syria's ballistic missiles used up on rebels." Reuters. December 18, 2015. Accessed February 7, 2018. https://www.reuters.com/article/mideast-crisis-syria-missiles/israel-says-90-pct-of-syrias-ballistic-missiles-used-up-on-rebels-idUSL8N13D4M220151118.

[8] Reuters Staff. "Yemen's Houthis fire ballistic missile toward Saudi Arabia." Reuters. January 20, 2018. Accessed February 7, 2018. https://www.reuters.com/article/us-yemen-security-saudi/yemens-houthis-fire-ballistic-missile-toward-saudi-arabia-idUSKBN1F90GO.

Methodology

The primary source of data for this research is a compiled data set on all ballistic missiles possessed by the world's nations as of May 2017. This data set was collected by Professor Michael Horowitz in conjunction with a team of undergraduate researchers at the University of Pennsylvania. Additionally, the Missile Technology Control Regime website (MTCR.info), provides data on MTCR partners and when they pledged to join the regime's anti-proliferation efforts. This paper analyzes the ballistic missile data set to evaluate missile diffusion over time on a global and regional basis to evaluate the efficacy of the MTCR. Specifically, the paper examines the number of new countries that have become missile states or advanced their ballistic missile capabilities since the launch of the MTCR in 1987. Additionally, this project takes a closer look at these states, reviewing relevant literature to draw conclusions and provide context to the acquisition or development of their ballistic missile arsenal. Lastly, this paper provides a holistic view of missile transfers before and after the implementation of the Missile Technology Control Regime using the data set.

Results

See appendix.

Discussion

Overview of Ballistic Missile Diffusion Since 1987

As of May 2017, there are 38 states which possess ballistic missiles. Of these states, 23 had ballistic missile arsenals prior to the implementation of the Missile Technology Control Regime in 1987. Hence, there have been 15 "new missile powers" since 1987 which have acquired or developed ballistic missile capabilities. Since 1987, many of the historical ballistic missile states have also furthered their arsenals either through development or transfers from other states. For the historical states, independent domestic development is the most common method of missile acquisition. Considering the missile data set, approximately 73.5% of missile acquisition is conducted through domestic development for the historical missile states, while 26.5% of acquisition is attributed to missile transfers from other states. Prior to the implementation of the MTCR, Europe had the greatest concentration of missile powers, closely followed by the Middle East, Asia, Africa, and North America.

The new missile powers have largely been clustered in the Middle East, which has seen the rise of 7 states (Afghanistan, Turkmenistan, Kazakhstan, United Arab Emirates, Bahrain, Turkey, and Pakistan) capable of fielding ballistic missiles in some capacity, followed by Europe with 4 states (Armenia, Belarus, Greece, and Slovakia), Asia with 3 states (Taiwan, India, and Thailand), and Latin America with 1 state (Argentina). Of the new missile powers, the

predominant means of acquisition has been missile transfers from the old missile states, accounting for 53.1% of missile acquisition as compared to domestic development with or without foreign assistance. This number, however, is skewed by the existence of determined proliferators like Pakistan which have concertedly pursued independent domestic development. In contrast, 10 of the 15 new missile states have only gained ballistic missile capabilities due to transfers from the historical states alone.

The states which have participated in the transfer of missiles to the new missile states include the United States, Russia, China, North Korea, and Iran, with the United States (29.4%) and Russia (64.7%) accounting for the greatest proportion of transfers. Of these missiles, they are predominantly short-range (less than 1,000km) and medium-range (1,000-3,000km). Indeed, of the new missile powers, only two have successfully developed intermediate-range missiles (3,000-5,500km): Pakistan's Ababeel (2200 km) and India's K-4/K-5 (3500 km). None have acquired or developed intercontinental (greater than 5,500km) ballistic missiles. The missile arsenals of the new missile powers more often than not are MTCR Category I with an initial inertial guidance system.

On the other hand, Pakistan, India, Taiwan, and Argentina have all succeeded in building their own ballistic missile arsenals through independent domestic development without foreign assistance or relying on a previous transfer of ballistic missile technology. Turkey, on the other hand, initially received a MGM-140A (ATACMS) from the United States in 1988 which began its journey toward domestic missile development. Its two domestically-developed missiles, the J-600T Yildirim I and J-600T Yildirim II, were both created with Chinese assistance in 2002.

These domestically-developed missiles are more varying in terms of range and technical sophistication; for example, the range of Pakistan's arsenal is 60 km at its lowest (Nasr) and 2,200 km at its greatest (Ababeel). On the other hand, for the new missile powers who have only received missiles through transfers, the range varies from 15 km at its lowest (FROG 7 - Armenia) and 1,100 km at its greatest (SS25 Sickle - Belarus).

Factors Mitigating MTCR Effectiveness

Subversion by MTCR Partners

Since 1987, the MTCR's effectiveness has largely been hindered by its own Partners who are engaging in proliferative activity contrary to the stated mission of the MTCR to restrict ballistic missile proliferation. The United States, one of regime's founding Partners, has perhaps been one of the worst offenders of the MTCR, engaging in repeated ballistic missile transfers since 1987, primarily in Europe, Asia, and the Middle East. These include ballistic missile sales to Turkey (1988), Thailand (1993), the United Kingdom (1994), Greece (1996), South Korea (1999), Bahrain (2000), and the United Arab Emirates (2011). Of these 7 missile transfers, 5 were MTCR Category I ballistic missiles transferred to the United Kingdom, Greece, South Korea, Bahrain, and the United Arab Emirates. With the exception of the missiles transferred to Thailand and South Korea, all had inertial guidance systems involving GPS, with the United Kingdom by far receiving the most sophisticated ballistic missile with MK6 astro-inertial guidance with GPS and computer-guided target selection. Of course, not all transfers should be judged equally. More concern should be given to missile transfers to states with a greater potential to use the weapons irresponsibly. With this logic, the transfer of ballistic missiles to trusted American security partners in their respective regions, like South Korea in the Asia-

Pacific and the United Kingdom in Europe, are less of a cause for concern considering that the chance of these states using their missiles irresponsibly is minimal.

Russia, who joined the MTCR in 1995, has also subverted its MTCR obligations by transferring ballistic missiles to Armenia in 2016. However, what is particularly striking is the extent of proliferative activity Russia was engaged in prior to becoming a Partner in 1995. Between 1987 and 1995, Russia transferred 10 ballistic missiles to a combination of historical and new missile states. However, after joining the MTCR in 1995, Russia's proliferative activity essentially ceased until its transfer of 1 ballistic missile (SS26) to Armenia in 2016.

Of the new missile states in Europe, all owe their missile acquisitions to U.S. and Russia missile transfers, rather than independent domestic development. Slovakia achieved a ballistic missile arsenal with the transfer of a SS23 Spider from Russia in 1991, as did Belarus with the receipt of a SS-1 Scud B, FROG-7, and SS25 Sickle from Russia. Armenia and Greece became missile powers due to the transfer of a SS21 Scarab, R-17 Elbrus, and FROG-7 from Russia in 1993 and MGM-140 from the United States in 1996, respectively. It is important to note that with the collapse of the Soviet Union, some of the East European states inherited the weapons on their territory as former members of the Soviet bloc. Slovakia and Belarus' missile acquisitions in 1991, coinciding with the disintegration of the U.S.S.R. in December 1991, are likely a consequence of this[9].

[9] Parker, Clifton B. "Why the Soviet nuclear arsenal stayed secure as the nation collapsed." Stanford Engineering. August 04, 2017. Accessed February 07, 2018. https://engineering.stanford.edu/magazine/article/why-soviet-nuclear-arsenal-stayed-secure-nation-collapsed.

It is possible that initial missile transfers can serve as a foundation for independent domestic development. Israel, Ukraine, and Libya all began down the path of proliferation through missile transfers from the historical missile states. Israel first received the Jericho-1 from France in 1968, which is subsequently used as a direct inspiration for the domestic development of the Jericho-2 in 1986. In Ukraine, the SS-1C Scud was first acquired from the Soviet Union in 1965; in just five years, Ukraine then was able to pursue domestic development of the UR-100N in 1970. Lastly, a similar pattern emerges for Libya: the country first received the R-17 Elbrus in 1975 and the FROG-7 in 1976 from the Soviet Union, then followed by domestic development of the Hwasong-6 in 1992. In all of these cases, independent domestic development was undertaken after precedent transfers of existing ballistic missile technology.

Missile Powers outside the MTCR

The existence of missile powers outside of the regime has also undermined the effectiveness of the Missile Technology Control Regime over its 30-year history. This makes sense; missile states who refuse to become Partners to the MTCR are free to engage in proliferative activity with other states non-party to the regime. The continued exclusion of China, Iran, and North Korea from the MTCR and Russia from 1987 to 1995 demonstrate the ability of missile powers outside the MTCR to subvert control efforts. China, Iran, and North Korea have all been responsible for missile transfers and missile development assistance, particularly in the Middle East. China, however, has agreed to adhere to MTCR guidelines, placing China both inside and outside the regime at the same time while its membership remains under review after applying to join the

MTCR in 2004[10]. This could explain the cessation of China's missile transfers over the last decade; China last sold a DF-21 in 2007 to Saudi Arabia.

There is also a glaring omission of Partners from the Middle East. As of May 2017, the sole adherent to the MTCR from the Middle East is Turkey, which joined the regime in 1997. 13 of 14 countries in the Middle East all possess a ballistic missile arsenal in some form but are not party to the MTCR: Iran, Yemen, Saudi Arabia, Egypt, Israel, Iraq, Afghanistan, Turkmenistan, Kazakhstan, the United Arab Emirates, Bahrain, and Pakistan. The implications of this are evident for restricting missile proliferation, as these nations are both free to transfer missiles both within and outside the Middle East. This has already been seen with Iran, who has previously transferred a Fateh-110 missile to Syria in 2007.

Conclusion

Over the past thirty years, the Missile Technology Control Regime has fallen short in impeding global ballistic missile proliferation. On an absolute basis alone, it seems that the MTCR has been successful: 15 states gained ballistic missile capabilities after 1987, compared to the 23 states which possessed ballistic missiles prior to its implementation. In this, it can be claimed that the Missile Technology Control Regime has effectively slowed down the rate of proliferation. Moreover, the new missile powers, with the exception of Pakistan and India, have been limited to short-range and medium-range ballistic missiles of relatively basic sophistication (inertial guidance system with a highly variable CEP). While it is inconclusive if the MTCR

[10] Zaborsky, Victor. "Does China Belong in the Missile Technology Control Regime?" Arms Control. October 1, 2004. Accessed February 07, 2018. https://www.armscontrol.org/act/2004_10/Zaborsky.

itself is directly responsible for this trend considering the existence of prevailing nation-specific variables, it is likely that the Regime's presumption of denial on the export of advanced missile technologies has contributed to the limited capabilities of the new missile powers' arsenals.

Of the new missile powers, the predominant means of acquisition has been missile transfers from the historical missile states, accounting for 53.1% of missile acquisition as compared to domestic development, Indeed, with 10 of the 15 new missile states only gaining ballistic missile capabilities due to transfers from the historical states alone, it is evident that the MTCR has been unable to entirely prohibit ballistic missile transfers to new states. The trade in ballistic missile technology continues. Moreover, the arsenals of these new missile powers are largely composed of ballistic missiles which meet the MTCR Category I classification. This stands in contrast to the Regime's strong presumption of denial on the export of these weapons. Particularly concerning is the subversion of the export regime by its own Partners. As discussed, the United States and Russia have continued to engage in the transfer of ballistic missiles since 1987. While the MTCR does not prohibit its Partners from engaging in missile transfers, the frequency in which the United States and Russia have participated in the practice undermines the integrity of the export regime as a voluntary, consensus-driven arrangement, and reinforces the reality that there are no consequences for violating the export regime.

It appears that the domestic development of ballistic missile can be catalyzed by missile transfers. In the case of Israel, Ukraine, and Libya, independent domestic development was undertaken after the transfers of existing ballistic missiles. With the requisite expertise and technology in-hand, these states were able to achieve the capability to develop more

sophisticated missiles with little to no state assistance. These states illustrate how proliferation can be exponentiated through the simple transfer of a short-range ballistic missile to another state, with the understanding that these transfers can provide a platform for independent development.

Lastly, the Missile Technology Control Regime has proven ineffective in curtailing proliferation in the Middle East. The region has become increasingly armed since 1987 through both domestic development and missile transfers, and only Turkey, out of 14 new and historical missile powers in the region, is party to the MTCR. This absence of MTCR adherence in the Middle East is perhaps one of the greatest factors undermining the effectiveness of the Regime both now and into the future, as the risk of both missile transfers or deployment in warfare continues to rise as proliferation continues.

Ultimately, the inadequacy of the Missile Technology Control Regime over the past thirty years demonstrates that it is time to strengthen the export regime.

- The subversion of the MTCR by its own Partners is a systemic weakness to the export control regime. As of now, there is little that can be done to enforce the Regime, considering that it is a voluntary arrangement among cooperative states. However, it would be useful to consider if it is time to move beyond a voluntary export regime to a treaty-based instrument, with the power to censure or sanction violators of the Regime.
- The MTCR places a strong presumption on the denial of Category I ballistic missile technology. However, those Partners which choose to engage in missile transfers may

inadvertently be catalyzing independent missile development by recipients, as documented in the case of Libya, Ukraine, and Israel. Partners should be diligent about this possibility in determining if it should export Category I or even non-Category I missiles to other states.

- The Middle East is a primary priority for integration into the export regime in order to stymie further proliferation in region. Working with Middle Eastern states to secure export control pledges and opening dialogue to integrate the region's missile powers into the Regime is a necessary step to revitalizing the MTCR.

While the Missile Technology Control Regime and its Partners acknowledge the impossibility of preventing missile proliferation entirely, it is evident that the Regime has become outdated since its inception three decades ago. In a geopolitical environment where ballistic missiles are more relevant than ever to state conflict, foreign relations, and national security strategy, anti-proliferation efforts must be founded upon a renewed Missile Technology Control Regime.

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Appendix

Historical Missile States

North America

United States (1987)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
MGM-5 Corporal	1954	Domestic	48-130, 600	Telemetry, ground radar, doppler	Yes
PGM-11 Redstone	1958	Domestic	240-320, 140	Inertial	Yes
SM-65 Atlas	1959	Domestic	10300-14484, unspecified	Inertial/radio	Yes
PGM-19 Jupiter	1960	Domestic	2980, unspecified	Inertial	Yes
MGM-31 Pershing	1960	Domestic	740-1770, 400	Inertial with active radar (terminal)	Yes
UGM-27 Polaris	1960	Domestic	2200-4600, 600	Inertial	Yes
Minuteman I	1962	Domestic	9260, unspecified	Inertial	Yes
Titan I/II/III/IV	1962	Domestic	10186-14967, unspecified	Inertial/radio	Yes
MGM-29	1962	Domestic	46-140,	Inertial	Yes

Sergeant			unspecified		
Minuteman II	1966	Domestic	12964, unspecified	Inertial	Yes
Minuteman III	1970	Domestic	9656, unspecified	Inertial	Yes
Poseidon C3	1971	Domestic	5280, 550	Inertial	Yes
MGM-52 Lance	1972	Domestic	4.8-120, 455	Inertial	Yes
LGM-118A Peacekeeper	1986	Domestic	9656-10900, 120	Inertial	Yes
Trident II D-5	1990	Domestic	7360-12000, unspecified	Inertial	Yes
ATACMS Block I/IA/II/IIA/IVA	1991	Domestic	165-300	Inertial/GPS with GPS and infrared (terminal)	Yes

Europe

United Kingdom (1987)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
PGM17 Thor IRBM	1959	United States	2000-2400, 100	Inertial with active radar (terminal)	Yes
UGM27 Polaris	1968	United States	2200-4600, 900	Inertial with active radar and	Yes

				computer-guided target selection (terminal)	
Trident D-5, UGM 133	1994	United States	2000-12000, 90	MK 6 astro-inertial with GPS and computer-guided target selection (terminal)	Yes

France (1987)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
S1 MRBM	1965	Domestic	N/A, unspecified	N/A	No
S2	1965	Domestic	3000-3500, unspecified	Inertial	No
M1 SLBM	1971	Domestic	N/A-3008, unspecified	Inertial	Yes
M2 SLBM	1974	Domestic	N/A-3200, unspecified	Inertial	Yes
Pluton (SRBM)	1974	Domestic	10-120, 150	Inertial with computer-guided target selection (terminal)	No
M20 SLBM	1977	Domestic	N/A-3000, 1000	Inertial with computer-guided target selection (terminal)	Yes
S3	1980	Domestic	3000-3450, unspecified	Inertial	No

M4A/B SLBM	1985	Domestic	4000-6000, 500	N/A	Yes
Hades (SRBM)	1988	Domestic	250-480, 100	Inertial with GPS, DSMAC, and computer-guided target selection (terminal)	No
M45 SLBM	1996	Domestic	4000-6000, 350	Inertial with computer-guided target selection (terminal)	Yes
M51 SLBM	2001	Domestic	6000-11000, unspecified	Astro-inertial with GPS and computer-guided target selection (terminal)	Yes

Germany (1987)

Missile	**Date Acquired**	**Method of Acquisition**	**Range (km) & CEP (m)**	**Guidance System**	**MTCR Category I?**
V-2 (A-4)	1942	Domestic	300-330, 4500	Gyroscope / Leitstrahl-Guide Beam	Yes

Italy (1987)

Missile	**Date Acquired**	**Method of Acquisition**	**Range (km) & CEP (m)**	**Guidance System**	**MTCR Category I?**
Alfa	1973	Domestic	1600,	Inertial	Yes

			unspecified		

Soviet Union/Russia (1995)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
SS21	1962	Domestic	300, 450-900	Inertial	Yes
SS19 Stiletto	1973	Domestic	10000, 400	Inertial with GPS and computer-guided target selection (terminal)	Yes
SS 18	1979	Domestic	16000, 250-1000	Inertial	Yes
R29	1973	Domestic	7800-9100, 1500	Astro-inertial with GPS (terminal)	Yes
SS24 Scalpel	1982	Domestic	11000, 500	Inertial autonomous	Yes
SS 25 Sickle	1988	Domestic	10500, 200	Inertial	Yes
RT2PM2 Topol	1997	Domestic	11,000, 200	Inertial	Yes
R29 RMU Sineva	1997	Domestic	8300-11000, 1400	Astro Inertial with GPS and computer-guided target selection (terminal)	Yes

SS 29 / SS27 Mod 2	2010	Domestic	2000-12000, 250	Inertial/Glonass with radar and computer-guided target selection (terminal)	Yes
R-29RMU2.1 Liner	2010	Domestic	11000, 1400	Inertial/Glonass with GPS and computer-guided target selection (terminal)	Yes
RSM56 Bulava	2011	Domestic	8000, 1400	Inertial with GPS and computer-guided target selection (terminal)	Yes

Hungary (1993)

Missile	**Date Acquired**	**Method of Acquisition**	**Range (km) & CEP (m)**	**Guidance System**	**MTCR Category I?**
SS-1C Scud B (R-17 Elbrus)	1970	Russia	300, 450	Inertial	Yes

Bulgaria (1994)

Missile	**Date**	**Method of**	**Range (km)**	**Guidance**	**MTCR**

	Acquired	Acquisition	& CEP (m)	System	Category I?
SS-1C Scud B (R-17 Elbrus)	1960	Russia	300, 450	Inertial	Yes
OTR-23 Oka (SS-23 Spider)	1986	Russia	50-500, 150	Inertial with DSMAC (terminal)	Yes

Romania

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
SS-1C Scud B (R-17 Elbrus)	1965	Russia	300, 450	Inertial	Yes
FROG-7 (9K52 Luna-M)	1982	Russia	15-70, 700	Unguided	No

Ukraine (1998)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
SS-1C Scud B (R-17 Elbrus)	1965	Russia	300, 450	Inertial	Yes
UR-100N (SS-19)	1970	Domestic	10,000, 920	Inertial	Yes
OTR-21 Tochka (SS-21 Scarab)	1976	Russia	70-185, 70	Inertial	No
RT-23	1980	Domestic	10,000 -	Inertial	Yes

(SS-24 Scalpel)			11,000, 500		

Asia Pacific

South Korea (2001)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Hyonmu 1/2/2A/2B	1987	Domestic	180-250, unspecified	GPS/INS	No
MGM-140B ATACMS	1999	United States	165, 50	Inertial	Yes

China

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
DF-3/3A (CSS-2)	1966	Domestic	2400-400, unspecified	Computer-guided target selection (terminal)	Yes
DF-4 (CSS-3)	1970	Domestic	4500-5500, 1400-3500	Computer-guided target selection (terminal)	Yes
DF-5 (CSS-4 Mod 1)	1980	Domestic	10000-12000, 500-3500	Computer-guided target selection (terminal)	Yes

JL-1/1A (CSS-N(X)-3)	1983	Domestic	1000-2150, 300-400	Computer-guided target selection (terminal)	Yes
DF-21 (CSS-5 Mod 1)	1985	Domestic	1750-2150, 700	Active radar and computer-guided target selection (terminal)	Yes
M-7/8610 (CSS-8)	1988	Domestic	150-180, 300	Computer-guided target selection (terminal)	Yes
DF-11 (M-11) (CSS-7 Mod 1)	1988	Domestic	280-350, 500-600	Computer-guided target selection (terminal)	Yes
DF-15 (M-9) (CSS-6 (presumably Mod 1)	1990	Domestic	600, 300	Computer-guided target selection (terminal)	Yes
DF-15A (CSS-6 Mod 2)	1996	Domestic	80-1000, 30-45	GPS, semi-active radar, and computer-guided target selection (terminal)	Yes
DF-31 (CSS-10 Mod 1)	1996	Domestic	3000-8000, 150-500	Computer-guided target selection (terminal)	Yes

DF-21A and DF-21E (CSS-5 Mods 2 and Mod 6, respectively.)	1996	Domestic	1750-2500, 50	GPS, active radar, and computer-guided target selection (terminal)	Yes
DF-11A (CSS-4 Mod 2)	1999	Domestic	300-600, 20-200	DSMAC and computer-guided target selection (terminal)	Yes
DF-16/16B (CSS-11 Mod 1 and (presumably) Mod 2)	2001	Domestic	800-1000, unspecified	GPS, semi-active radar, and computer-guided target selection (terminal)	Yes
DF-15B and DF-15C (CSS-6 Mod 3 and 4, respectively)	2006	Domestic	600-800, unspecified	GPS, active radar, and computer-guided target selection (terminal)	Yes
DF-21C (CSS-5 Mod 4	2007	Domestic	1750-1770, 40-50	GPS and active radar (terminal)	Yes
DF-31A (and 31B) (CSS-10 Mod 2)	2007	Domestic	11000-12000, 300	GPS and computer-guided target selection (terminal)	Yes
DF-5B and DF-5C (CSS-4 Mod 3	2008	Domestic	13000-15000, 500	Computer-guided target	Yes

(DF-5B) and Mod 4 (DF-5C))				selection (terminal)	
JL-2 (CSS-NX-14 or CSS-N-5)	2009	Domestic	2000-8000, 150-300	GPS and computer-guided target selection (terminal)	Yes
DF-21D (CSS-5 Mod 5 (ASBM))	2010	Domestic	1400-2000, 20-40	GPS, infrared, active radar, semi-active radar, and computer-guided target selection (terminal)	Yes
DF-26, DF-26B, and DF-26C	2012	Domestic	3000-4000, 100	Computer-guided target selection (terminal)	Yes
DF-41 (CSS-X-20)	2016	Domestic	10000-15000, 100-500	GPS and computer-guided target selection (terminal)	Yes
DF-5A (CSS-8	2017	Domestic	13000-15000, 500-800	Computer-guided target selection (terminal)	Yes

Vietnam

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?

RUR-5 ASROC	1960	United States	0.8-13, unspecified	Inertial	No

Middle East

Iran

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Naze'at-4 (Mushak-160)	1975	Domestic	70-120, unspecified	N/A	No
Naze'at-6	1975	Domestic	100-105, unspecified	N/A	No
Naze'at-10	1975	Domestic	140-150, 7	N/A	No
Oghab	1975	Domestic	35-45, unspecified	N/A	No
Shahin-1	1975	Domestic	13, unspecified	N/A	No
Shahin-2	1975	Domestic	20, unspecified	N/A	No
Scud-B (Shahab-1 and R-17/R-300)	1985	Libya and North Korea	300, 450	Inertial	Yes
Tondar-69 (CSS-8)	1990	China	150-180, 50-100	Inertial	No
Scud-C (Shahab-2)	1991	North Korea	500-550, 700	Inertial	Yes
Shahab-3 (No Dong-1)	1993	North Korea	800-1300, 2500	Inertial	Yes
DF-11 (CSS-7)	1995	China	120-350, 600	Inertial	Yes

Fateh-110	1996	Domestic	100-170, unspecified	N/A	No
Zelzal-1	1998	Domestic	125-150, unspecified	N/A	No
Zelzal-2	1998	Domestic	210-300, unspecified	N/A	Yes
DF-15	2001	China	200-800, 280	Inertial	Yes
Fateh-100A	2002	Domestic	200-210, unspecified	Inertial with GPS (terminal)	No
Modified Shahab-3 (Ghadr-1)	2004	Domestic	1000-2500, unspecified	Inertial	Yes
SS-N-6 (BM-25 Musudan)	2006	North Korea	2500-4000, 1600	Inertial	Yes
Zelzal-3	2007	Domestic	150-400, unspecified	N/A	Yes
Zelza-3B	2007	Domestic	200-260, unspecified	N/A	No
Fateh-3	2010	Domestic	250, 250	Inertial with GPS (terminal)	No

Yemen

Missile	**Date Acquired**	**Method of Acquisition**	**Range (km) & CEP (m)**	**Guidance System**	**MTCR Category I?**
Scud-B (R-17 Elbrus)	1990	Yemeni Unification	190-550, 450	Inertial	Yes
FROG-7	1990	Yemeni	12-68, 400-	N/A	No

(9K52 Luna-M)		Unification	700		
SS21 Scarab (OTR 21 Tochka)	1990	Yemeni Unification	70-185, 95-160	Inertial with GPS(terminal)	No
Scud Mod-C (Hwasong-6)	2001	North Korea	575-600, 700	Inertial	Yes

Saudi Arabia

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
DF-3 (CSS-2)	1987	China	2500-3500, 1000-4000	Inertial	Yes
DF-21 (CSS-5)	2007	China	500-2150, 300-700	Inertial with active radar (terminal)	Yes

Egypt

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
al-Zafir	1962	Domestic	350-430, 1600	Inertial	Yes
al Kahir	1962	Domestic	8-600, 1600	Inertial	Yes
FROG-7B (R-70 Luna-M)	1968	Russia	70, 500-700	N/A	No
Scud-B	1973	Russia	280-300, 400	Inertial	Yes
Sakr-80	1987	Domestic	80, unspecified	N/A	No

Scud-C (Hwasong-6)	1996	Domestic	500-600, 700	Inertial	Yes
Project T (Scud-B-100)	1996	Domestic with North Korean assistance	450, unspecified	Inertial	Yes

Syria

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
FROG-7 (9K52 Luna-M)	1970	Russia	15-70, 400-700	Inertial	No
Scud-B (R-17 Elbrus)	1973	Russia	300-450, 450	Inertial	Yes
SS-21 Scarab (OTR-21 Tochka)	1983	Russia	70-120, 95-160	Inertial with GPS and active radar (terminal)	No
Scud Mod-C (Hwasong-6)	1990	North Korea	500-600, 700-1000	Inertial	Yes
Scud-D (Hwasong-7)	2000	North Korea	700-995, 50-190	Inertial with DSMAC (terminal)	Yes
Fateh-110 (M-600)	2007	Iran	200-300, 100	Inertial with GPS (terminal)	Yes

Israel

Missile	Date	Method of	Range (km)	Guidance	MTCR

	Acquired	Acquisition	& CEP (m)	System	Category I?
Jericho-1(YA-1)	1968	France	420-750, 1000	Inertial	Yes
MGM-52 Lance	1975	United States	4.8-130, 455	Inertial	No
Jericho-2 (YA-2)	1986	Domestic	800-3500, 1000	Inertial	Yes
Jericho-3 (YA-3)	2008	Domestic	4800-6500, 1000	Inertial with GPS (terminal)	Yes

Iraq

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Scud-B (R-17 Elbrus)	1975	Soviet Union	300, 450-1000	Inertial	Yes
Al-Hussein	1988	Domestic	600-650, 1600-3200	Inertial	No
Al-Samoud II	2000	Domestic	150-183, unspecified	Inertial	No

Africa

South Africa (1995)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
RSA-2	1984	Domestic	1100, 1000	Inertial with computer-guided target selection (terminal)	Yes

RSA-2	1986	Domestic	1900, 1000	Inertial with computer-guided target selection (terminal)	Yes
RSA-3	1989	Domestic	1450-1800, 1000	Inertial with computer-guided target selection (terminal)	No

Libya

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
R-17 Elbrus (Scud-B)	1975	Soviet Union	300, 900-1000	Inertial	No
FROG-7 (9K52 Luna-M)	1976	Soviet Union	68-70, 500-700	N/A	No
Scud-B (R-17 Elbrus)	1976	Soviet Union	300, 900-1000	Inertial	Yes
Hwasong-6 (Scud-B)	1992	Domestic	500, 900	Inertial	No
Scud-C (Hwasong-6)	1999	North Korea	500-600, 700-1000	Inertial	Yes

New Missile States

Europe

Armenia

Missile	Date	Method of	Range (km)	Guidance	MTCR

	Acquired	Acquisition	& CEP (m)	System	Category I?
FROG 7 (9K52 Luna-M)	1993	Russia	15-65, 400-700	N/A	No
R-17 Elbrus (SS-1C Scud-B)	1993	Russia	50-300, unspecified	Inertial	Yes
SS21 Scarab (OTR21 Tochka)	1993	Russia	15-120, 95-160	Inertial with GPS, infrared, and computer-guided target selection (terminal)	No
SS26 (Iskander)	2016	Russia	50-500, 7	Inertial/GPS/ GLONASS with GPS, infrared, and computed-guided target selection (terminal)	Yes

Belarus

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
SS-1 Scud-B	1991	Russia	300, 900	Inertial with GPS and computer-guided target selection (terminal)	Yes
FROG-7 (9K52 Luna M)	1991	Russia	15-65, 400-700	N/A	No

SS25 Sickle (RT-2PM Topol)	1991	Russia	1100, 900	Inertial with computer-guided target selection (terminal)	Yes

Greece (1992)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
MGM-140 (ATACMS)	1996	United States	128-300, unspecified	Inertial with GPS (terminal)	Yes

Slovakia

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
SS23 Spider (OTR 23 Oka)	1991	Russia	50-480, 30-150	Inertial	Yes

Latin America

Argentina (1993)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Alacran	1989	Domestic	200, unspecified	Inertial	Yes

Asia-Pacific

Taiwan

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Tien Chi I/II/IIA	1997	Domestic	5-125, unspecified	GPS	No

India (2016)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Prithvi 1/2/3	1994	Domestic	40-150, 50	Inertial	Yes
Dhanush	2010	Domestic	250-400, 50	Inertial or GPS	Yes
Agni 1/2/3/4/5/6	2004	Domestic	1250, 25	Inertial	Yes
K-4/K-5	2017	Domestic	3500, unspecified	Ring laser gyro	Yes

Thailand

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
RUM-139 (VL-ASROC)	1993	United States	22-28, unspecified	Inertial	No

Middle East

Afghanistan

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Scud-B	1988	Russia	300, 450	Inertial/gyroscope	Yes

Turkmenistan

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Scud-B	1991	Russia	300, 450	Inertial/gyroscope	Yes

Kazakhstan

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Scud-B	1991	Russia	300, 450	Inertial/gyroscope	Yes

United Arab Emirates

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Scud-B (R-17 Elbrus)	1989	North Korea	190-550, 450	Inertial	Yes
MGM-140 (ATACMS)	2011	United States	128-300, unspecified	Inertial with GPS (terminal)	Yes

Bahrain

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m0	Guidance System	MTCR Category I?
MGM-140 (ATACMS)	2000	United States	128-300, unspecified	Inertial with GPS (terminal)	Yes

Turkey (1997)

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
MGM-140A (ATACMS)	1988	United States	165, unspecified	Inertial with GPS (terminal)	No
J-600T Yildirim I (CSS-X-11)	2002	Domestic with Chinese assistance	80-150, unspecified	Inertial	No
J-600T Yildirim II	2002	Domestic with Chinese assistance	80-300, unspecified	Inertial	Yes

Pakistan

Missile	Date Acquired	Method of Acquisition	Range (km) & CEP (m)	Guidance System	MTCR Category I?
Hatf 1/1A/1B	1992	Domestic	70, 1000	N/A	No

Shaheen 1/2/3	2003	Domestic	750, 200	Inertial	Yes
Ghauri/Hatf 5	2003	Domestic	1250, 2500	GPS (terminal)	Yes
Hatf-III	2004	Domestic	290, 250	Inertial	Yes
Hatf 2	2013	Domestic	180, unspecified	N/A	No
Nasr (Haft-9)	2013	Domestic	60, unspecified	N/A	No
Ababeel	2017	Domestic	2200, unspecified	N/A	Yes